



Range extensions for recently described North American species of *Acentrella* Bengtsson (Insecta: Ephemeroptera: Baetidae)

Jeffrey M. Webb^{1,3} & Steven K. Burian²

¹Rhithron Associates, Inc., 33 Fort Missoula Road, Missoula, MT, USA 59804

²Department of Biology, Southern Connecticut University, 501 Crescent St., New Haven, CT, USA 06515

³Corresponding author. E-mail: jwebb@rhithron.com

Abstract. New state records are provided for two recently described species of North American *Acentrella* Bengtsson, 1912. *Acentrella nadineae* McCafferty, Waltz & Webb, 2009 is newly reported from Connecticut, Massachusetts, and Minnesota, and *A. rallatoma* Burian & Myers, 2011 is reported from Minnesota.

Key words. Range extension; Nearctic; new records; mayfly

The Holarctic small minnow mayfly genus *Acentrella* Bengtsson, 1912 (Ephemeroptera: Baetidae) is a commonly encountered mayfly in lotic systems throughout North America. Of the 9 species known from North America, 3 were described within the last 10 years (JACOBUS & McCAFFERTY 2006, McCAFFERTY et al. 2009, BURIAN & MYERS 2011), and DNA evidence suggests additional undescribed species are present (WEBB et al. 2012). Species-level identification keys are available for nymphs that include all 9 species (JACOBUS & McCAFFERTY 2006, BURIAN & MYERS 2011) and for male imagos that includes 7 of the 9 species (BURIAN & MYERS 2011). Herein, we present first US state records for 2 of the recently described species, *A. nadineae* McCafferty, Waltz & Webb, 2009 and *A. rallatoma* Burian & Myers, 2011.

Specimens were obtained from processing aquatic biomonitoring samples collected by the Minnesota Pollution Control Agency (MPCA) and the Connecticut Department of Energy and Environmental Protection (CTDEEP) as well as collecting by the authors. Specimens were collected using a variety of standard methods and preserved in 80% ethanol. Locality details are presented in Table 1. Specimens are deposited in the Purdue Entomological Research Collection, Purdue University, West Lafayette, IN, USA (PERC), Northeast Ephemeroptera Laboratory, Department of Biology, Southern Connecticut University, New Haven, CT (NEL), and with the MPCA and CTDEEP.

Nymphs of *A. nadineae* (Fig. 1) are distinguished from those of other North American *Acentrella* by the combination of an absence of hind wingpads, shortened fore tarsi and tibiae, and large, asymmetrical gills with basal brown shading (MCCAFFERTY et al. 2009). The adults of *A. nadineae* are not described. Nymphs of *A. rallatoma* (Fig. 2) are identified by the combi-

nation of cerci with alternating light and dark segments, the absence of hind wingpads, mandibles with outer incisors fused into a scraping blade, brown abdominal terga with a median pale spot, and the absence of brown coloration in the gills. The adult males of *A. rallatoma* are differentiated from other North American *Acentrella* by the combination of the absence of hind wings, lack of raised posterior margins on the abdominal terga, penes cover trapezoidal with straight apical margin and brown hour-glass shaped marking, white abdominal terga with complex markings, and forewings > 4.0 mm in length (BURIAN & MYERS 2011).

Acentrella nadineae has previously been reported from the US states of Kentucky, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Virginia, and West Virginia (Fig. 3; previous records lack geocoordinates and are frequently imprecise,



Figure 1. Dorsal habitus of *Acentrella nadineae*.



Figure 2. Dorsal habitus of *Acentrella rallatoma*.

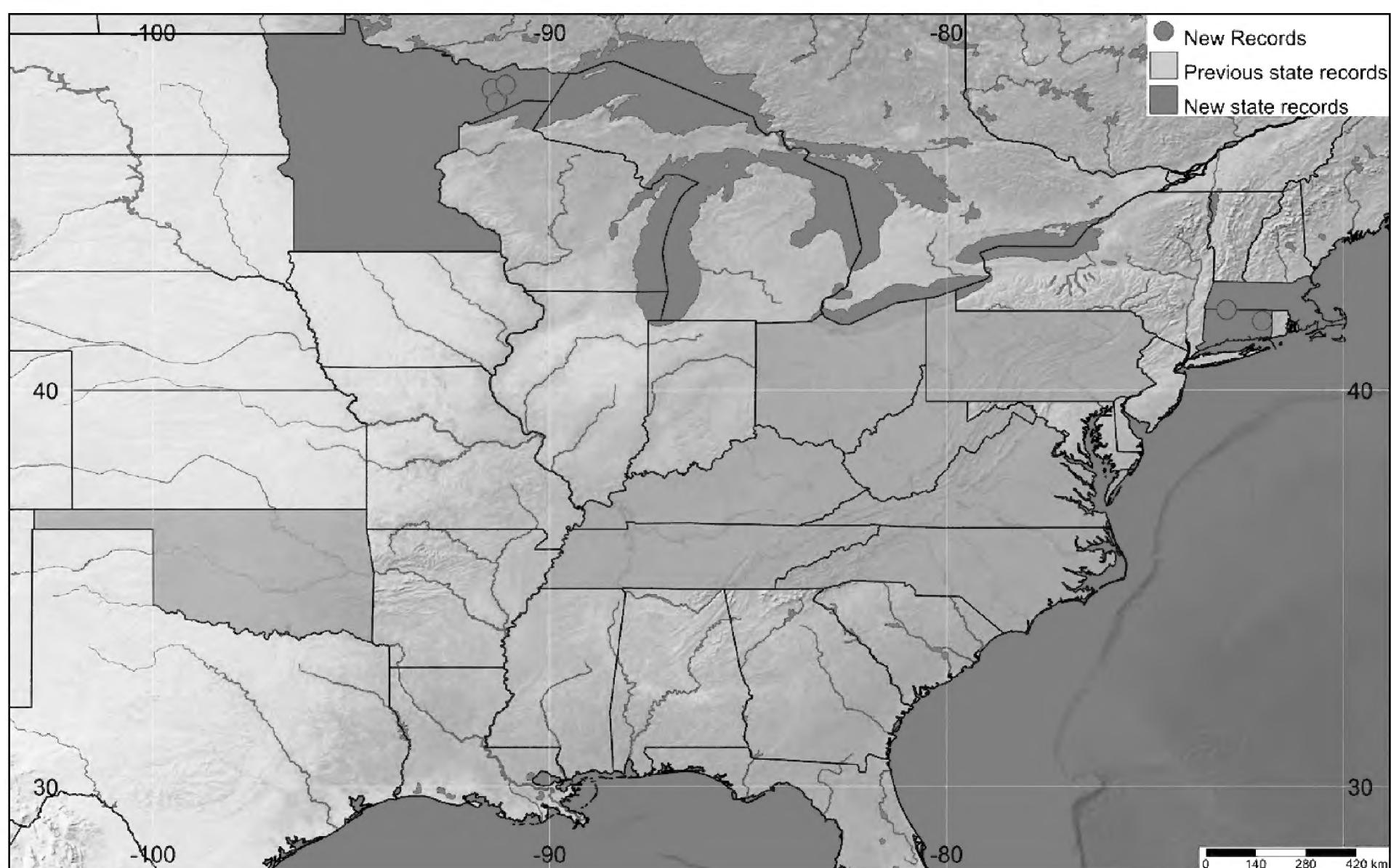


Figure 3. Point map of localities of *Acentrella nadineae*. New state records are represented by yellow fill, with localities indicated with red circles; states from which the species has previously been reported are filled in with solid grey.

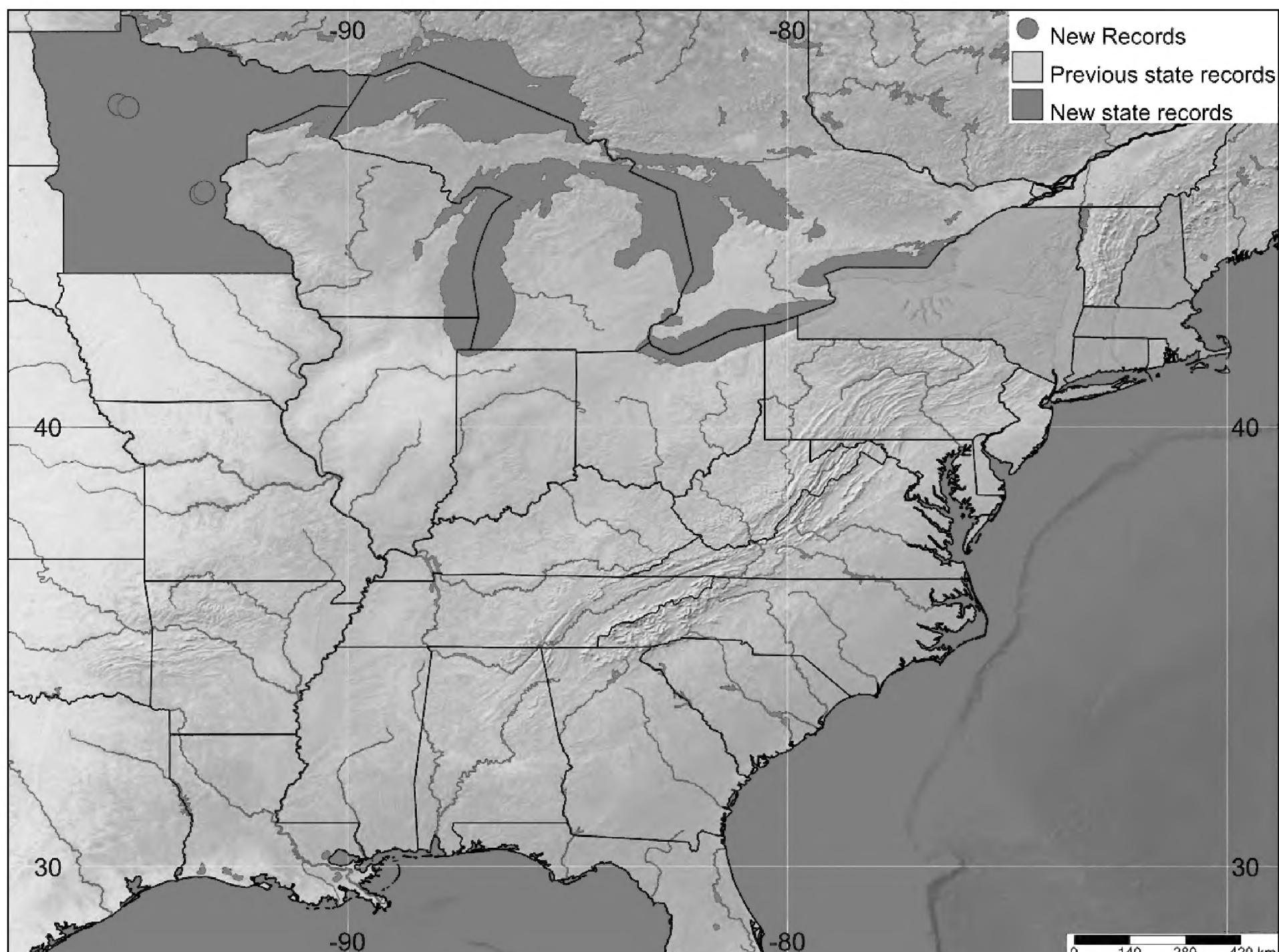


Figure 4. Point map of localities of *Acentrella rallatoma*. New state records are represented by yellow fill, with localities indicated with red circles; states from which the species has previously been reported are filled in with solid grey.

Table 1. Collection locality and deposition data for *Acentrella nadineae* and *A. rallatoma*

Taxon	State	County	Locality	Latitude	Longitude	Date	Count	Collector	Specimen ID	Deposition
<i>A. nadineae</i>	CT	Hartford	Hubbard River, ~150m dnstr. of MDC weir, from swift water chutes between large cobble and small boulders, Hartland	42.036	-72.9387	20-Jun-2012	1 nymph	S.K. Burian	ACE-NAD0002	NEL
<i>A. nadineae</i>	CT/MA	Hartford (CT)/Hampden (MA)	Hubbard River, ~65m upstr. USGS gauge sta., from swift water chutes	42.0385	-72.9405	2-Aug-2015	1 S♂ & 1 Nex	S.K. Burian	ACE-NAD0010	NEL
<i>A. nadineae</i>	CT/MA	Hartford (CT)/Hampden (MA)	Hubbard River, ~65m upstr. USGS gauge sta., from swift water chutes	42.0385	-72.9405	2-Aug-2015	1 S♀ & 1 Nex	S.K. Burian	ACE-NAD0011	NEL
<i>A. nadineae</i>	CT/MA	Hartford (CT)/Hampden (MA)	Hubbard River, ~65m upstr. USGS gauge sta., from swift water chutes	42.0385	-72.9405	2-Aug-2015	1 ♀ & Nex	S.K. Burian	ACE-NAD0012	NEL
<i>A. nadineae</i>	CT/MA	Hartford (CT)/Hampden (MA)	Hubbard River, ~65m upstr. USGS gauge sta., from swift water chutes	42.0385	-72.9405	2-Aug-2015	5 nymphs	S.K. Burian	ACE-NAD0013	NEL
<i>A. nadineae</i>	CT/MA	Hartford (CT)/Hampden (MA)	Hubbard River, ~50m upstr. USGS gauge sta., from swift water chutes	42.0385	-72.9405	30-Jul-2013	1 S♂ & 1 Nex	S.K. Burian	ACE-NAD0003	NEL
<i>A. nadineae</i>	CT/MA	Hartford (CT)/Hampden (MA)	Hubbard River, ~50m upstr. USGS gauge sta., from swift water chutes	42.0385	-72.9405	30-Jul-2013	1 S♂ & 1 Nex	S.K. Burian	ACE-NAD0004	NEL
<i>A. nadineae</i>	CT/MA	Hartford (CT)/Hampden (MA)	Hubbard River, ~50m upstr. USGS gauge sta., from swift water chutes	42.0385	-72.9405	30-Jul-2013	1 S♂ & 1 Nex	S.K. Burian	ACE-NAD0005	NEL
<i>A. nadineae</i>	CT/MA	Hartford (CT)/Hampden (MA)	Hubbard River, ~50m upstr. USGS gauge sta., from swift water chutes	42.0385	-72.9405	30-Jul-2013	1 S♂ & 1 Nex	S.K. Burian	ACE-NAD0006	NEL
<i>A. nadineae</i>	CT/MA	Hartford (CT)/Hampden (MA)	Hubbard River, ~50m upstr. USGS gauge sta., from swift water chutes	42.0385	-72.9405	30-Jul-2013	1 S♀ & 1 Nex	S.K. Burian	ACE-NAD0007	NEL
<i>A. nadineae</i>	CT/MA	Hartford (CT)/Hampden (MA)	Hubbard River, ~50m upstr. USGS gauge sta., from swift water chutes	42.0385	-72.9405	30-Jul-2013	1 ♀ & 1 Nex	S.K. Burian	ACE-NAD0008	NEL
<i>A. nadineae</i>	CT/MA	Hartford (CT)/Hampden (MA)	Hubbard River, ~50m upstr. USGS gauge sta., from swift water chutes	42.0385	-72.9405	30-Jul-2013	5 nymphs	S.K. Burian	ACE-NAD0009	NEL
<i>A. nadineae</i>	MN	Lake	Beaver River	47.2594	-91.3567	12-Aug-2015	1 nymph	MPCA	MN15BL025	MPCA
<i>A. nadineae</i>	MN	Lake	Cedar Creek	47.32	-91.3198	26-Aug-2013	5 nymphs	MPCA	MN13JC200-0001	PERC
<i>A. nadineae</i>	MN	Lake	Harriet Creek	47.7055	-91.1126	13-Aug-2015	2 nymphs	MPCA	MN15BL015	MPCA
<i>A. nadineae</i>	MN	Lake	Stony River	47.6033	-91.4695	19-Aug-2014	1 nymph	MPCA	MN14BL037-0001	PERC
<i>A. nadineae</i>	MN	Lake	Stony River	47.6033	-91.4695	17-Aug-2015	6 nymphs	MPCA	MN15BL108	MPCA
<i>A. rallatoma</i>	MN	Anoka	Cedar Creek	45.3027	-93.3455	8-Aug-2013	31 nymphs	MPCA	MN13JC370-0001	PERC
<i>A. rallatoma</i>	MN	Anoka	Cedar Creek	45.356	-93.2576	5-Aug-2013	12 nymphs	MPCA	MN13JC408-0001	PERC
<i>A. rallatoma</i>	MN	Clearwater	Mississippi River	47.339	-95.2092	3-Sep-2013	1 nymph	MPCA	MN13JC207	MPCA
<i>A. rallatoma</i>	MN	Hubbard	Hennepin Creek	47.3984	-95.0866	31-Jul-2013	6 nymphs	MPCA	MN13JC136-0001	PERC
<i>A. rallatoma</i>	MN	Hubbard	Schoolcraft River	47.2682	-94.9879	27-Aug-2013	13 nymphs	MPCA	MN13JC131-0001	PERC
<i>A. rallatoma</i>	MN	Hubbard	Schoolcraft River	47.2682	-94.9879	28-Aug-2013	9 nymphs	MPCA	MN13JC132-0001	PERC
<i>A. rallatoma</i>	MN	Mille Lacs	Rum River, West Branch	45.581	-93.6145	19-Aug-2013	3 nymphs	MPCA	MN13JC379	MPCA
<i>A. rallatoma</i>	MN	Watowwan	Watowwan River	44.0567	-94.504	15-Aug-2013	1 nymph	MPCA	MN13JC430	MPCA

so are only illustrated at the state level) (McCafferty 2009, 2011, McCafferty et al. 2009, Webb et al. 2012). New records include localities in northeastern Minnesota, Connecticut, and Massachusetts (Fig. 3, Table 1) and represent northwestern and northeastern range extensions. It is likely that *A. nadineae* will also occur in nearby areas such as southern Ontario and Quebec as well as in other eastern states. Specimens may have already been collected from these areas, but misidentified as *A. turbida* McDunnough, 1924 because specimens of *A. nadineae* would terminate on *A. turbida* in identification keys available prior to 2009.

Acentrella rallatoma was previously thought to be restricted to second- and third-order streams in Connecticut, Massachusetts, New Hampshire, and New York (Burian & Myers 2011) (Fig. 4). The occurrence of the species in Minnesota (Table 1) represents a range extension of > 1500 km. Given the historical misidentification of nymphs of *A. rallatoma* as *A. parvula* (Burian & Myers 2011), it is possible that *A. rallatoma* is more widespread than our data show. Alternatively, it may be that the Minnesota populations of *A. rallatoma* are actually a different, but highly similar allopatric species than those found in the New England region of North America.

ACKNOWLEDGEMENTS

The authors thank the Minnesota Pollution Control Agency for allowing the use of specimen records.

LITERATURE CITED

- BENGSSON, S. 1912. Neue Ephemeriden aus Schweden. Entomologisk Tidskrift 33: 107–117.
- BURIAN, S.K. & L.W. MYERS. 2011. A new species of *Acentrella* Bengtsson (Ephemeroptera: Baetidae) from New York and New England (USA), redescription of the nymph of *A. parvula* (McDunnough), and key to known adult males of Nearctic *Acentrella*. Aquatic Insects 33: 305–334. <https://doi.org/10.1080/01650424.2011.639305>
- JACOBUS, L.M. & W.P. McCAFFERTY. 2006. A new species of *Acentrella* Bengtsson (Ephemeroptera: Baetidae) from Great Smoky Mountains National Park, USA. Aquatic Insects 28: 101–111. <https://doi.org/10.1080/01650420600784855>
- MCCAFFERTY, W.P. 2009. New state and provincial North American records for 100 Ephemeroptera species. Transactions of the American Entomological Society 135: 353–368. <https://doi.org/10.3157/061.135.0302>
- MCCAFFERTY, W.P. 2011. Notable new North and Central American records of Ephemeroptera species. Transaction of the Ameri-

- can Entomological Society 137: 1–10. <https://doi.org/10.3157/061.137.0101>
- McCAFFERTY, W.P., R.D. WALTZ & J.M. WEBB. 2009. *Acentrella nadineae*, a new species of small minnow mayflies (Ephemeroptera: Baetidae). Proceedings of the Entomological Society of Washington 111: 12–17. <https://doi.org/10.4289/0013-8797-111.1.12>
- McDUNNOUGH, J. 1924. New Canadian Ephemeroptera with notes, II. Canadian Entomologist 55: 90–98, 113–122, 128–133. <https://doi.org/10.4039/Ent5539-2>
- Webb, J.M., L.M. Jacobus, D.H. Funk, X. Zhou, B.C. Kondratieff, C.J. Geraci, R.E. DeWalt, D.J. Baird, B. Richard, I. Phillips and P.D.N. Hebert. 2012. A DNA Barcode Library for North American Ephemeroptera: Progress and Prospects. PloS one 7: e38063.
- Authors' contributions:** JMW and SKB collected the data, identified specimens, and wrote the text.

Received: 7 September 2016

Accepted: 22 March 2017

Academic editor: Lucimar Gomes-Dias